PATENT SPECIFICATION

DRAWINGS ATTACHED

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Int. Cl.:—B 29 d

COMPLETE SPECIFICATION

Glazing Closure

We, LIBBEY-OWENS-FORD GLASS COMPANY, a Corporation organized under the laws of the State of Ohio, United States of America, of 811 Madison Avenue, City of Toledo, County of Lucas, and State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to glare-reducing glazing closures and, more particularly, to a novel filmed glass sheet, or assembly including such sheet, especially adapted for use as an automobile vehicle window or other structural viewing closure.

It has heretofore been proposed to provide an anti-glare screen in an automobile windshield where elimination or reduction of glare from the sun and sky or from objectionably bright, artificial light is desired. This has been accomplished commercially by providing a glare-reducing portion in the plastic interlayer of a laminated windshield assembly.

It has also been recently proposed to reduce the visible light and solar radiation transmittance through single sheet, heat treated automobile rear windows by providing on one surface thereof a coating of a metallic oxide. The use of such coatings has been necessitated for the most part by the increased size of the rearwindows, particularly in the upper margins thereof, which now frequently extend over the rear seat and replace portions of the conventional car roof. This greater glass area, in some cases, causes discomfort, particularly for back seat passengers, due to increased solar radiation influx into the passenger compartment.

While the use of these recently developed coated back windows having a glare-reducing film applied to one surface thereof has been effective in substantially reducing the transmittance of light and solar radiation therethrough and thereby alleviating to some extent the discomfort resulting from the glare and heat, it has not heretofore been possible to lower such transmittance to the minimum degree which would be desirable without causing an extremely detrimental iridescence of oil slick reflection of different colors on the back window.

In this respect, it has been determined that for all practical purposes the lowest visible light transmittance and highest solar radiation reflection properties that can be obtained without causing iridescence with the use of a single glass sheet provided with a metal oxide film on one major surface thereof are approximately 26 percent and 23 percent, respectively, for regular plate glass, and 22 percent and 13 percent, respectively, for heat absorbing plate glass, the radiation reflectance in this regard being measured from the glass side. This, of course, is much better than the light transmittance and solar radiation reflectance of approximately 89 percent and 8 percent, respectively, for uncoated plate glass, and approximately 73 percent and 7 percent, respectively, for uncoated heat absorbing plate glass but it has been found to be vary desirable to a obtain a still further reduction.

Although it is extremely advantageous to reduce or substantially eliminate light glare and solar radiation as above noted, it will be appreciated that it is additionally necessary to apply and distribute the glare and heat reducing medium to provide a glazing closure, e.g. an automobile rear window, which will transmit an adequate amount of light, will not unnecessarily darken or objectionably interfere with the view of the occupants of the rear seat or impair the driver's safe view, through his rear view mirror and back window, of the road con-

ditions to the rear of the car. In other words, the back window should incorporate the desirable features of extremely low visible light transmittance and high solar radiation reflectance without impairing the necessary light transmittance required for safety and utility. Consequently, iridescence, which has heretofore been considered a necessary evil in the denser metal oxide films, cannot be tolerated in automotive glazing.

It has now been discovered, and the instant invention is based upon such discovery, that an extremely effective and highly advantageous glare-reducing glazing or view-in closure including a plurality of glass surfaces can be produced by providing a band or zone thereon comprising at least a pair of low light transmitting and high solar radiation reflecting films, one of which films is formed on one of the glass surfaces and another on a corresponding portion of a second glass surface. In this respect, the glazing closure may comprise a single glass sheet thereby including just two major surfaces, and the glare-reducing band would then comprise two films provided on corresponding and opposed portions of the surfaces. Also, in the case of an automobile vehicle glazing, e.g. a back window, the glare-reducing band preferably is provided on only a restricted area thereon adjacent one longitudinal edge portion of the glass sheet and additionally is tapered in thickness from said longitudinal edge inwardly thereof while, in architectural glazings, the band or zone would preferably extend completely over the entire area of the sheet and be of substantially uniform thickness throughout.

Further, the invention is also adapted for glazings including more than one glass sheet and therefore having more than two major sheet surfaces, e.g. laminated structures and multiple sheet architectural units in which the sheets are joined together entirely around their marginal edges in spaced face-to-face relation to provide a hermetically sealed structure. In this regard, the band or zone may comprise at least two low light transmitting and high solar radiation reflecting films, such films either being provided on corresponding and opposed portions of the two major surfaces of one of the glass sheets of the assembly or on one major surface of one sheet and another major surface of another sheet, the films in the latter instance also being placed on corresponding portions of the sheets so that they are directly opposed, i.e. aligned or arranged so that a line normal to the surfaces and through one film also passes through the other film. It has been discovered that the provision of coatings of the class described on at least two corresponding major surfaces of a glazing closure produces the desired extremely low light transmittance and high solar radiation reflectance without correspondingly producing iridescence, as happens, for example, when merely increasing the thickness of such a coating applied to only one major surface of a glass sheet.

It is, therefore, a principal object of the invention to provide an improved glazing unit closure.

Another object of the invention is to provide a glazing closure having a glare reducing band or zone appropriately located thereon which is effective to provide the minimum visible light transmittance therethrough and maximum solar radiation reflectance therefrom without initiating iridescence.

A further and more specific object of the invention is to provide an automobile window including a sheet of glass having a filmed area of a minimum light transmittance and maximum solar radiation reflectance provided on corresponding restricted areas of both the inner and outer surfaces thereof adjacent the upper longitudinal edge portion of the window, the lower portion of the filmed area being vignetted so that the light transmittance increases from a minimum in the upper portion of the filmed area to that of clear glass in the portion of the window below the filmed area.

In the accompanying drawings:

Fig. 1 is a fragmentary, perspective view illustrating a glazing closure in accordance with the invention in its installed position;

Fig. 2 is a view in elevation of the glazing closure;

Fig. 3 is a vertical sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary, perspective view of a further modification of a glazing unit embodying the instant invention; and

Fig. 5 is a vertical sectional view taken along the line 5—5 of Fig. 4;

According to the present invention there is provided a glazing closure including a plurality of clear glass surfaces having a glare-reducing zone formed thereon and extending over at least a portion of said closure, said zone comprising a first low light transmitting and high solar radiation reflecting film on one of said glass surfaces and a second low light transmitting and high solar radiation reflecting film on a corresponding portion of another of said surfaces said zone being non-iridescent and having a light transmittance of less than 23%.

It should be here noted that although the invention will be described in detail in connection with automotive vehicle glazings, it is also adapted for use with other types of glazing units such as hereinbefore set forth, the specific embodiments being for purposes of illustration only and not to be considered limitative.

According to one embodiment of the invention, the novel glazing closure herein provided includes a sheet of glass having a glare-reducing band on a restricted area thereof adjacent one longitudinal edge of the sheet, which band in turn comprises two films of low light transmittance and high solar radiation reflectance, one of which is provided on corresponding opposed portions of each major surface of the sheet.

The filming material employed in producing glazing closure in accordance with the invention may suitably comprise a metal oxide formed by spraying various metal salts onto a heated glass sheet, and which metal oxide is effective to filter out, by absorption and reflectance, at least a portion of the light and solar radiation normally passing through an untreated glass viewing closure. Various metal oxides have been found to be effective in this respect, among which may be mentioned as examples, cobalt oxide, tin oxide, titanium oxide, iron oxide and/or mixtures thereof. Particularly excellent results have been obtained with the use of cobalt oxide films since it has been found that cobalt oxide provides the maximum protection with regard to both lowering the light transmittance and raising the solar radiation reflectance, for a given thickness of oxide film employed. These oxide films are best obtained by spraying a solution of a salt or compound of the desired metal onto a heated glass sheet whereby the salt or compound reacts at the glass surface to form the oxide. It should be noted that the specific identity of the metal oxide film is not of particular importance insofar as the present invention is concerned, so long as it is effective to screen or filter out at least a portion of the light and solar radiation normally passing through a glazing closure, and to have a light transmittance of less than 23%. As previously noted, any of the oxides known to so act are capable of use in accordance with the invention.

Referring now to the drawings, and particularly to Figs. 1 to 3, there is shown an automobile indicated generally at 10 having a rear window opening 11 in which is provided a glazing closure indicated generally at 12. The glazing closure 12 comprises a glass sheet of pre-determined curvature which has been treated to include a band 13 of controlled light transmittance and solar radiation reflectance thereon in accordance with the invention. The band 13 is composed of two films 14 and 15 provided on corresponding restricted portions of the inner and outer major surfaces 16 and 17, respectively, of the glass sheet and provides the lowest light transmittance and highest solar radiation reflectance in its thickest portion of area with respect to the interior of the automobile that is possible for a functional rear window as limited by safety requirements.

As best seen in Fig. 3, each film 14 and 15, together forming the band 13, is graded in thickness transversely of the glass sheet, being of greatest thickness adjacent the upper longitudinally extending edge 18 thereof, and gradually and progressively decreasing in thickness until the coating or film is substantially non-existent at about one-fourth of the distance down the sheet from the edge 18. In this manner then, the films are vignetted at their lower portions so that the light transmittance increases from a minimum in the upper portion of the filmed area to that of clear glass in the portion 19 of the window below the film area. The thickness of the film is preferably substantially uniform across the longitudinal extent of the sheet between the side edges 20 and 21 at any given distance down from the upper edge 18, i.e. along any horizontal longitudinally extending line or axis of the bent glass sheet.

In producing a glazing closure as illustrated in Figs. 1 to 3, the bent glass sheet to be filmed, is first heated to a temperature of between approximately 600° F. and 1250° F. When filming annealed glass, the temperature should be above the strain point of the glass, namely, above 960° F.; and when filming or coating tempered glass, the temperature may be between 600° F. and 960° F. and is preferably between about 750° F. and 800° F. The hot glass surfaces are then sprayed with a filming solution, normally maintained at room temperature, by means of conventional spray guns or the like. One method of varying the degree of light transmittance across the transverse extent of the glass and thereby producing the previously mentioned graded or vignetted effect is to use a spray gun which emits a spray that is tapered in density and oriented to impart its thick region along a longitudinal edge of the glass sheet and the feathered or vignetted edge of the thin region of the spray aligned with the portion of the sheet where the coating is desired to end. It will be appreciated that the thickness of the film or coating deposited will depend on various factors, for example, the concentration of the solution employed, the time of impingement of the spray and, additionally, the rate of flow of the spray. For practical purposes, a filming solution of maximum concentration without precipitation is employed in order that a film of the desired thickness is formed on the glazing closure in a minimum amount of time.

The width or transverse extent of the filmed area may be varied so as to coincide with the portion of the glazing closure adapted to form a part of the roof of the automobile since this is the area through which

the transmittance of a high degree of solar radiation tends to cause the greatest discomfort to back seat passengers. For example, the band shown in Figs. 1 to 3, as previously described, covers approximately one-fourth of the transverse extent of the closure and is, in this manner, located above the heads of passengers seated in the rear of the automobile. Generally speaking, however, the back window may be sprayed so that the film will be restricted to that area of the window which is above the driver's line of sight through his rear view mirror.

With the use of the majority of filming solutions effective to produce films or coatings in accordance with the invention, and including metal salts which react to form the oxide or oxides of the particular metal upon contact with a heated glass surface, it has been found desirable to include a small amount of a suitable wetting agent in order to lower the surface tension of the solution. In this respect, a filming solution of a cobalt metal salt has been found to be most advantageously employed when having a surface tension value of between about 28 to 30 dynes per square centimeter. One such wetting agent which has been found to be highly effective in insuring uniformity of distribution of the film is alkylpolyoxyethylenethioether, although various other commercially available wetting agents or surfactants may also be employed.

Particularly excellent results have been obtained in providing glare-reducing bands in accordance with the invention with the use of a cobalt propionate solution as the filming medium whereby cobalt oxides are formed upon contact thereof with the heated glass surface. It has been found that a water solution of cobalt propionate is effective and may readily be prepared at room temperature for film spray operations. The addition of between about .05 to .15 millilitres of a wetting agent such as previously described per 100 milliliters of solution to reduce the surface tension of the water alone or of cobalt propionate-water-propionic acid solutions, which may also be employed if stability of the solution is a factor, will produce a better film. It should be noted that the solubility of cobalt propionate in water has been found to be approximately 33 grams in 100 milliliters at room temperature and increases to approximately 35 to 37 grams when the solvent is heated to a higher temperature, for example, about 180° F.

While solutions such as discussed above have been prepared using water as a solvent, or a mixture of water and propionic acid as a solvent, satisfactory filming solutions of cobalt propionate have also been prepared using methanol as a solvent. For example, a satisfactory film of cobalt oxides may be achieved by spraying a heated base with a filming solution including approximately 45 grams of cobalt propionate per 100 milliliters of methanol.

In addition to cobalt propionate, various other organic salts of cobalt may be used as the cobalt oxides supplying substance. For example, satisfactory results have been obtained when using the following cobalt salts dissolved in a suitable solvent: cobalt 2-ethyl hexanoate, cobalt octate, cobalt acetyl acetonate, cobalt acetate.

Various other colored metal oxides in addition to cobalt may be successfully employed in accordance with the invention to obtain the minimum light transmittance and maximum solar radiation reflectance possible with each without causing iridescence, it only being necessary that each oxide possesses the necessary light and solar radiation filtering or screening out effect. In this respect, the oxides of nickel, cadmium and iron, or mixtures thereof, may be used as the film material as well as a nickel oxide-manganese oxide mixture. It has been found that the chlorides of these metals are suitable salts which are effective to react and form the oxides thereof when contacted with a heated glass surface, as are to some extent the acetates and nitrates. It will be appreciated that the particular salt chosen and employed should be soluble to at least some measure in a commercially available solvent. With the use of these oxides, as in the case of cabalt oxides, the density or thickness of each film should be the maximum possible without producing iridescence.

Referring now to Figs. 4 and 5, a further embodiment of the present invention is illustrated. As shown therein, a bent glass sheet 25 which has been treated in accordance with the invention to provide a band 26 composed of two films 27 and 28 of low light transmittance and high solar radiation reflectance is incorporated into a windshield structure, i.e. a laminate glass assembly, as indicated generally at 29. The windshield structure 29 comprises in addition to the glass sheet 25, a substantially identically sized and shaped glass sheet 30 together with an interposed layer 31 of a transparent thermoplastic material such as polyvinyl butyral adhered to and bonding together the glass sheets 25 and 30.

As was the case with the filmed backlight or rear window, each film 27 and 28 is vignetted at its lower portion and fades into the clear glass surface 32 to provide an adequate viewing area for the automobile driver or operator. It has been found that the use of a coated windshield as illustrated provides the maximum protection from glare and solar radiation and additionally provides various other advantages over currently employed structures, wherein the polyvinyl butyral sheet is tinted. For example,

the dyes or tints now used are subject to deterioration over extended periods of time and use, whereas the films for use in accordance with the invention are much more permanent and also much easier to apply to sheets to be tempered or laminated. The films may be provided either on both major surfaces of one sheet of the laminated assembly, as shown, or one film may be provided on either major surface of the inner sheet and the other on either major surface of the outer sheet.

The following Examples constitute the best presently known modes for carrying out the present invention and obtaining a glazing closure in accordance therewith:

Example I

A solution containing 32 grams of cobalt propionate and 0.05 milliliters of alkylpolyoxyethylenethioether per 100 milliliters of water was prepared. A bent sheet of tempered plate glass 1/4 inch thick and adapted for use as a glazing closure for an automobile rear window was coated with the above solution immediately after removal from a tempering chamber and while at a temperature of about 775° F. The sheet was coated on corresponding restricted and opposed portions of both major surfaces thereof by passing the same, first with one surface up and then the other, horizontally beneath a pair of spray nozzles traversing across the full longitudinal extent of the sheet. The nozzles to sheet distance was maintained substantially constant during the traversing movement of the nozzles by means of being operably associated with a suitable cam bar corresponding to the curvature of the sheet. The spray, through approprate design of the nozzles, was tapered in density and oriented so as to direct its region of greatest density along the longitudinal edge of the bent sheet adapted to form the upper edge of the glazing closure, and the vignetted portion of the spray aligned with the horizontal longitudinal line whereat the coating was desired to fade into the clear glass area. The spray solution formed a film comprised of cobalt oxides on both major surfaces of the glass sheet, the thickness of each film in the area thereof adjacent the upper longitudinal edge being approximately 30 to 50 millimicrons.

The light transmittance and solar radiation reflectance of the film sheet adjacent the upper longitudinal edge thereof were then measured. It was found that the visible light transmittance (illuminate C_1 which is one of the standard illuminates recommended by the International Commission on illumination, and approximates to daylight) was 13.5 percent and the total solar radiation reflectance 33.25 percent with either filmed surface towards the sun. The total radiation transmittance was also measured and found to be 23.5 percent. There was no iridescence produced by the resulting filmed sheet when viewed from either side. The light transmittance of the filmed area of the remainder of the glass sheet gradually increased until reaching that of clear glass at the terminating extent of the vignetted area.

The procedure of Example 1 was repeated employing slightly greater film thicknesses in each subsequent test in order to determine the lowest possible visible light transmittance obtainable without causing iridescence. Iridescence was produced when the total visible light transmittance was 8 percent.

For purposes of comparison, another tempered plate glass sheet having the same dimensions and composition as the sheet of Example I was coated by the same procedure and with the same solution as recited in Example I, except that only a restricted portion of one major surface thereof was filmed. When the area of this portion adjacent the upper longitudinal edge of the sheet, having the same thickness as the corresponding filmed area of Example I, namely 30 to 50 millimicrons, was measured for visible light transmittance and solar radiation reflectance (from the glass side), it was found that these values were 26 percent and 23 percent, respectively. In this same connection, iridescence appeared when the film thickness was increased to give a visible light transmittance of 25 percent.

Example II

The procedure of Example I was repeated, except that 1/4 inch heat-absorbing glass was substituted for the plate glass used therein. Transmittances of 18-1/2 percent, 13 percent and 8.0 percent were obtained without any iridescence by varying the thicknesses of the coatings. Upon subsequent tests using this heat-absorbing glass as the coating base, iridescence was observed when the visible light transmittance was decreased to 4.5 percent.

When, for purposes of comparison, but not in accordance with the invention, the same composition 1/4 inch heat-absorbing glass was coated on one surface only with the solution of Example I, the minimum visible light transmittance obtainable without iridescence was only 22 percent.

Example III

A 1/8 inch thick, bent plate glass sheet adapted for use in a laminated windshield structure was filmed on corresponding restricted areas of both major surfaces thereof by heating the sheet to 1150° F. and thereafter immediately contacting the surfaces with the same filming solution and in the identical manner as recited in Example I. The thickness of each film in the densest area

thereof was approximately 30 to 50 millimicrons. A second 1/8 inch thick plate glass sheet having the same size and shape as the filmed sheet, but not filmed, was then laminated to the filmed sheet by standard commercial procedures using a layer of polyvinyl butyral .015 inch thick as the adhesive material. Upon testing this laminated structure for visible light transmittance and solar radiation reflectance, it was found that these values were 11.0 percent and 38.7 percent, respectively, the radiation reflectance test being performed with the exposed filmed surface of the first sheet being towards the sun. The total solar radiation transmittance was determined to be 19.3 percent. No iridescence was observed with the resulting structure. The radiation reflectance from the exposed glass surface of the assembly was found to be 27.4 percent.

When, for purposes of comparison, a substantially identical but unfilmed laminated windshield structure was tested, the total light transmittance thereof was found to be 80 per cent and the solar radiation reflectance 8 percent.

Example IV

The procedure of Example III was repeated, except that 1/8 inch thick heat-absorbing glass was substituted for the plate glass used therein. A visible light transmittance value of 9.1 percent and a solar radiation reflectance value (from the exposed filmed surface) of 36.8 per cent were obtained for this assembly without iridescence. Radiation reflectance from the exposed unfilmed glass surface of the laminated assembly was measured at 16.6 percent while the total solar radiation transmittance was determined to be 8.5 percent.

Example V

A pair of laminated windshield assemblies, each comprised of two 1/8 inch thick, bent plate glass sheets were produced. In one assembly (Windshield A), a film composed of cobalt oxides was formed from the same filming solution as recited in Example I on corresponding restricted portions of one major surface of each of two sheets, and the sheets were then laminated together with a .015 inch thick strip of polyvinyl butyral so that both films were exposed, i.e. the unfilmed major surface of each sheet was adjacent the butyral strip. A film comprised of cobalt oxides was also formed on corresponding restricted portions of one major surface of each of two other sheets from the same filming solution as recited in Example I, and these sheets were then laminated together with a .015 inch thick strip of polyvinyl butyral so that the filmed surface of both sheets was in contact with the butyral strip in order to form the second of the assemblies (Windshield B). The film thickness in all instances in the thickest portions thereof was between approximately 30 to 50 millimicrons. The assemblies were then tested with the following results:

	Windshield A	Windshield B
Visible Light Transmittance (Illuminate C)	9.3	12.8
Solar Radiation Reflectance		
1) from either filmed surface - - -	39.1	—
2) from either exposed glass surface -	—	27.0
Solar Radiation Transmittance	17.2	22.4

It may be possible to still further reduce the visible light and total radiation transmittance through a multiple sheet glazing assembly without initiating iridescence by providing films on corresponding portions of three, four or even more surfaces of the unit depending chiefly, of course, on whether such further reduction is desirable to the extent of the additional cost which would be necessitated to produce such a unit.

It will now be apparent that a novel and highly efficient glazing closure is produced in accordance with the invention, and that such glazing closure is effective to provide an extremely low light transmittance therethrough, and an extremely high solar radiation reflectance therefrom, while still conforming with all safety requirements necessary to such closures.

WHAT WE CLAIM IS:—

1. A glazing closure including a plurality of clear glass surfaces having a glare-reducing zone formed thereon and extending over at least a portion of said closure, said zone comprising a first low light transmitting and high solar radiation reflecting film on one of said glass surfaces and a second low light transmitting and high solar radiation reflecting film on a corresponding portion of another of said surfaces, said zone being non-iridescent and having a light transmittance of less than 23 percent.

2. A glazing closure in accordance with claim 1, in which said films are provided over the entire area of the surfaces to which they are applied and are of substantially uniform thickness throughout.

3. A glazing closure comprising a sheet of clear glass, said sheet having a glare-reducing band on a restricted area thereof adjacent one edge of the sheet consisting of a pair of metal oxide films of low light transmittance and high solar radiation reflectance, one of which films is provided on each major

surface of the glass sheet and on corresponding opposed portions thereof, said band being noniridescent and having a light transmittance of less than 23 percent.

4. A glazing closure including a pair of substantially identically sized and shaped superimposed clear glass sheets laminated together with a transparent thermoplastic material interposed therebetween, said closure having a glare-reducing band provided on a restricted area thereof adjacent one edge of the closure comprising a pair of metal oxide films of low light transmittance and high solar radiation reflectance, said films being provided on two different major surfaces of said glass sheets and on corresponding portions thereof, said band being non-iridescent and having a light transmittance of less than 23 percent.

5. A vehicle glazing closure including a plurality of elongated clear glass surfaces and a glare-reducing band adjacent one longitudinal edge of said closure, said band comprising a first metal oxide film of low light transmittance and high solar radiation reflectance on one of said glass surfaces and a second low light transmitting and high solar radiation reflecting metal oxide film on a corresponding portion of another of said surfaces, said films varying in thickness from a maximum at those portions thereof nearest said one edge of said closure to a minimum at those portions thereof farthest from said one edge and being of substantial uniform thickness along any horizontal longitudinally extending line across said surfaces, said band being non-iridescent and having a light transmittance of less than 23 percent adjacent at least the thickest portion thereof.

6. A vehicle glazing closure as defined in claim 5, in which each of said films has a thickness in the range of from 30 to 50 millimicrons adjacent at least said one longitudinal edge of the closure.

7. A vehicle glazing closure as defined in claim 6, in which said metal oxide films consist essentially of cobalt oxides.

8. A glazing closure including a plurality of heat-absorbing glass surfaces having a glare-reducing zone formed thereon and extending over at least a portion of said closure, said zone comprising a first metal oxide film of low light transmittance and high solar radiation reflectance on one of said glass surfaces and a second low light transmitting and high solar radiation reflecting metal oxide film on a corresponding portion of another of said surfaces, said zone being non-iridescent and having a light transmittance of less than 22 percent.

9. A vehicle glazing closure including an elongated sheet of clear glass, said sheet having a glare reducing band on a restricted area thereof adjacent one longitudinal edge of the sheet comprising a pair of films consisting essentially of cobalt oxides, one of which films is provided on each major surface of the glass sheet and on corresponding opposed portions thereof, said films varying in thickness from a maximum in the range of from 30 to 50 millimicrons at that portion thereof nearest said one longitudinal edge of the sheet to a minimum at that portion thereof farthest from said one edge and being of substantially uniform thickness along any horizontal longitudinally extending line across said sheet, said band being non-iridescent and having a light transmittance of less than 23 percent adjacent at least the thickest portion thereof.

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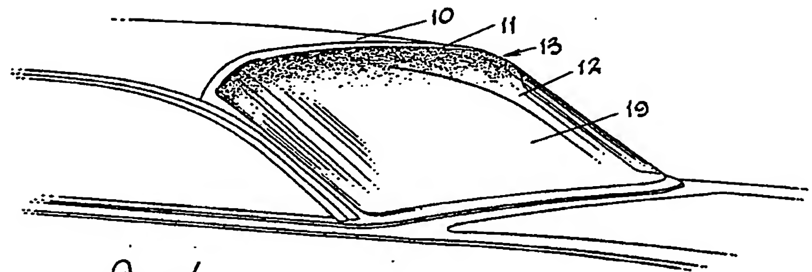

Fig.1

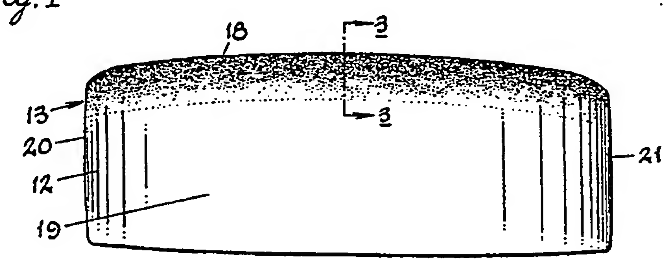

Fig.2

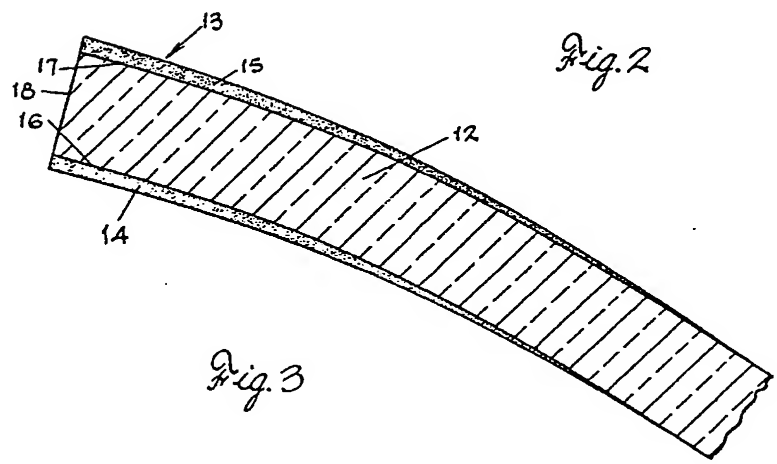

Fig.3

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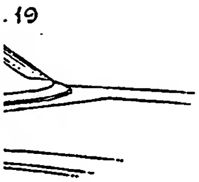
Sheets 1 & 2



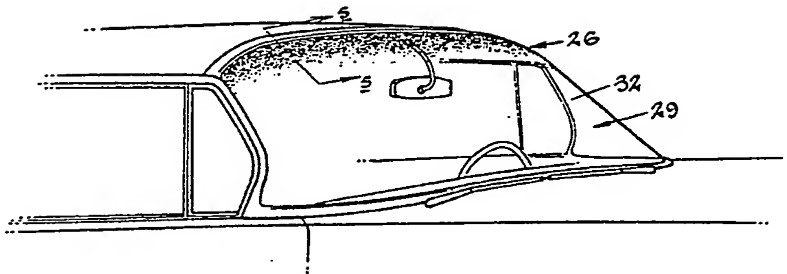
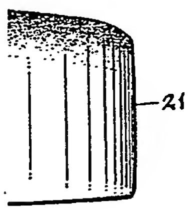
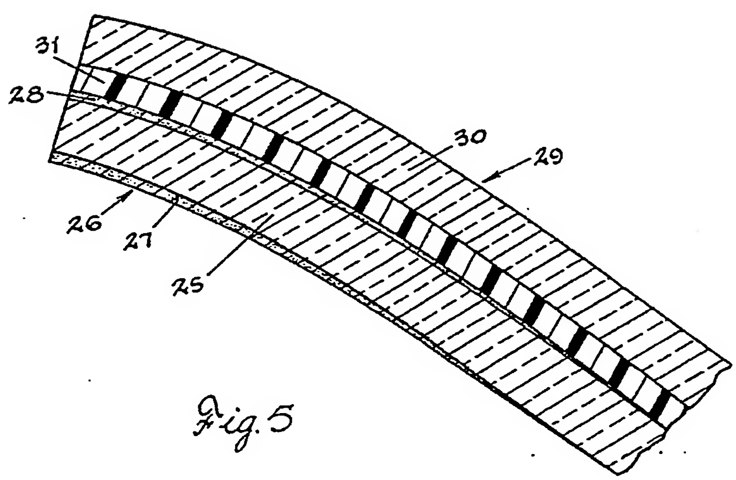


Fig. 4





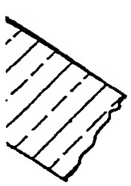


Fig. 5

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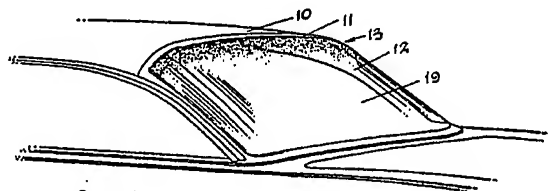

Fig. 1

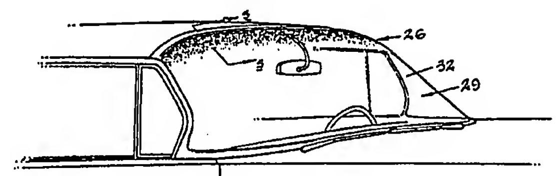

Fig. 4

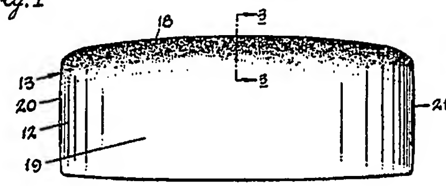

Fig. 2

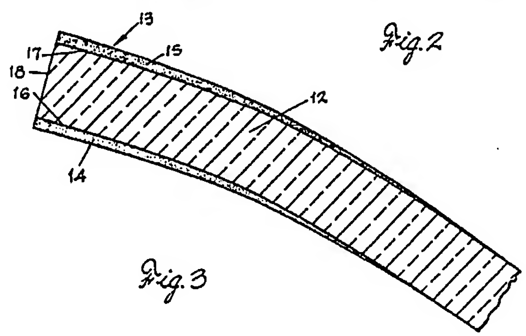

Fig. 3

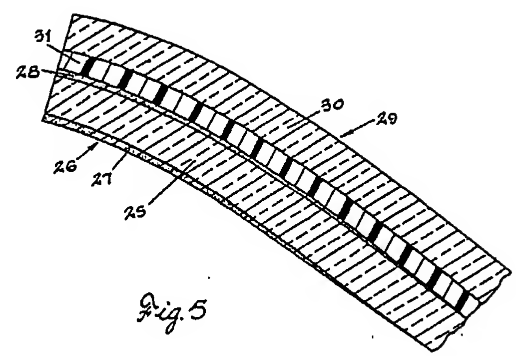

Fig. 5

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